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ABSTRACT

Early Effects of Cognitive-Impairment Friendly Community on Health Care Utilization in China: Evidence from Administrative Data

The study examines the early effects of cognitive-impairment (CI) friendly communities on health care utilization among older adults in Shanghai, China. By exploiting the rollout of CI-friendly communities and employing a difference-in-differences approach, we evaluate the impact of CI-friendly communities. We find that CI-friendly communities significantly increase the probability and frequency of visiting cognition-disease-related departments (CRD) by 0.7 (13.73%) percentage points and 0.02 (17.24%) times, respectively. In particular, the effect is more pronounced for individuals not previously received CRD care. The dominant mechanisms may include information and early screening effects. Additionally, CI-friendly communities affect health care utilization in other positive ways, such as reducing emergency room (ER) visits and promoting primary care use.

JEL Classification: I18, J14, I11

Keywords: CI-friendly community, health care utilization, awareness of cognitive impairment

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1. Introduction

Cognitive impairment (CI) includes a broad spectrum of deficits affecting various aspects of cognitive functioning in individuals. CI has various stages, progressing from mild cognitive impairment (MCI) to dementia. The global population living with dementia was about 50 million in 2019 and is expected to exceed 150 million by 2050 (Alzheimer's Disease International, 2019). CI has many adverse effects at the individual, family, and societal levels, such as downward spirals in health behavior and health status (Lin and Chen, 2022), impaired disease awareness, management, and decision-making capability (Lin et al., 2023), excess health care needs, and significant economic burdens (Zhao et al., 2008). Individuals may begin accruing larger expenditures than usual, even before a diagnosis of CI (Albert et al., 2002; Geldmacher et al., 2013; Suehs et al., 2013).

Early diagnosis of CI may offer significant benefits, including the opportunity for early treatment of reversible causes, sufficient time for better care management, preparation for advanced care planning, and delaying institutionalization (Giezendanner et al., 2019; Patnode et al., 2020). To enhance the well-being of dementia patients and their families, the WHO sets out a global action plan on the public response to dementia for 2017–2025 (WHO, 2017), promoting dementia and CI awareness and fostering a dementia-friendly society. However, dementia remains largely undiagnosed worldwide. Alzheimer's Disease International estimated that 75% of people with dementia are undiagnosed, with the rate of never being diagnosed as high as 90% in some lower- and middle-income countries (Alzheimer's Disease International, 2021). Among U.S. older adults who had initial symptoms of CI, only 9.8% received a memory-related diagnosis within a year (Qian et al., 2021), and only 40% of Americans who had incident dementia received a dementia diagnosis over a four-year time window (Chen et al., 2019).

China has a large population with CI. In 2020, the number of older adults with CI in China was approximately 15.07 million, which is predicted to increase to 22.2 million by 2030 (Chinese Association for the Elderly, 2021). To develop a national action plan, the Chinese government has placed greater focus on the cognitively impaired population. With the challenge of prevalent CI in its local population, Shanghai has piloted a CI-friendly community program since the third quarter of 2019, with plans to roll out to the entire city by 2025. By the end of 2022, the CI-friendly community program has reached 80% of communities in Shanghai. CI-friendly community program is designed to operate through four key components: health education(especially knowledge about CI), early screening for CI, early intervention and therapeutic support for CI patients, and respite care or support for family caregivers.

In the short term, CI-friendly communities may influence health care utilization in two main dimensions. First and foremost, health education has been shown to improve health care utilization(Rasu et al., 2015; Visscher et al., 2018), promoting the use of preventive care(Cho et al., 2008). After the implementation of CI-friendly communities, older adults —particularly those with no prior exposure to information or screening— may be more inclined to seek cognition-related care due to their greater awareness of the CI risks via early-screening services, booklets and other outreach activities of CI-friendly communities, which we refer to as the *information effect*. Also, the information effect may help older adults better manage their health through enhanced health awareness. Second, the effectiveness of community-based care has been well-established in aged care and chronic disease management(Ahn et al., 2013; Reynolds et al., 2018; Woodall et al., 2023). CI-friendly communities may substitute for some health management in primary care facilities by providing some interventions and treatments, such as physical training or rehabilitation, which we identify as *the substitution effect*. It is also possible that CI-friendly communities may to a lesser extent substitute for visits to CRD in higher level health facilities, considering that there has been lack of effective treatment for cognitive impairment and dementia. Even in developed countries lack of affordable pharmaceutical innovations to treat this disease has been a strong argument against getting a formal diagnosis of CRD.

We examine the effects and test the underlying mechanisms of introducing the CI-friendly community program to some pilot communities—a policy experiment—on health care utilization in Shanghai, China. Our analysis uses claim-level administrative data from 2017 to 2021, which contains precise and comprehensive information about outpatient visits, hospital admissions, and medical expenditures.

We aim to contribute to the literature in two major aspects. First, to our knowledge, this study is the first to reveal the early effects of CI-friendly communities. Existing studies have evaluated several other policies and interventions in different settings, and found that they may help individuals with CI improve their quality of life or may reduce CI incidence in the population. For instance, early screening of CI promotes early-stage detection (Borson et al., 2013; Holsinger et al., 2007); collaborative care in primary clinics and caregivers for patients with CI improves their behavioral and psychological symptoms (Callahan et al., 2006); integrated health and social care are advocated to encourage a CI-friendly society (Draper et al., 2018); long-term care insurance may reduce the lifetime medical expenses of older adults with dementia (Moon et al., 2021); dementia special care units in nursing homes reduce hospitalizations (Gruneir et al., 2007; Joyce et al.,2018); and neighborhood-built environments protect cognition to reduce the risk of dementia (Chen et al., 2022).

Second, our findings shed light on how CI-friendly communities may reshape health care utilization. Existing studies have examined the changes in health care use and medical expenditure after the diagnosis of CI. Zhu et al. (2015) demonstrate a notable increase in inpatient admissions but non-significant increases in the use of outpatient visits, home health, and skilled nursing facilities after the diagnosis of dementia. Hoffman et al. (2022) show rising health care utilization across various areas, including physician services, inpatient admissions, home health, and skilled nursing facilities, following the first dementia diagnosis. Lin et al. (2016) observe similar patterns of increased utilization in inpatient care, post-acute care in skilled nursing facilities, and home health care following the diagnosis of CI. By contrast, based on detailed administrative panel data, our investigation focuses on CRD services usage and examines heterogeneities by community characteristics, personal experience with the health care system, and level of health care facilities.

The rest of the paper is organized as follows. Section 2 describes the policy and its institutional background. Section 3 discusses data and lays out our empirical strategy. Section 4 reports our findings, including primary and stratified results, as well as robustness checks. Section 5 provides a brief discussion. Finally, section 6 concludes.

2. The Institutional Background

2.1. The CI-friendly Community Program in Shanghai

In recent years, China's National Health Commission has initiated CI prevention and treatment programs, aiming to promote public awareness of Alzheimer's prevention to 80% of the older population and increase the screening rate of cognitive function among community-dwelling older adults to 80%.[1]

[1] http://www.nhc.gov.cn/jkj/s7914/202009/a63d8f82eb53451f97217bef0962b98f.shtml

Launched in 2019, Shanghai's CI-friendly community pilot program provides an example of the CI screening and prevention system in China. CI-friendly communities are established for four main purposes: First, they disseminate knowledge about CI in the communities. Volunteers explain the symptoms of cognitive disorder to older adults at aged care institutions or at home; Second, professional health workers offer early screening for CI risk—voluntary and free for older adults—at community health centers or aged care institutions or at home; Third, they establish community support centers to intervene with people who have CI, such as through physical training, playing music and games, leveraging the resources of community aged care institutions and health care centers; Fourth, they train family caregivers and relieve their stress. The program hinges strongly on professionals and community aged care and health care institutions to perform these tasks.

Four waves of pilots have been implemented in Shanghai, i.e., October 2019, September 2020, September 2021, and September 2022. By the end of 2022, the number of pilot communities had reached 170, accounting for 80% of all communities in the city. By the end of 2025, all communities are expected to be covered.

The pilot communities were selected and funded by the Bureau of Civil Affairs of Shanghai. The selection was based on the basic characteristics of the communities. Communities with larger populations of older adults were more likely to take part in the pilot. The aged-care capacity, such as the number of aged-care facilities and the size of the community health care center, was another consideration, as the program requires a number of professional aged-care and health care workers. The program also encouraged the participation of nonprofit organizations specializing in cognition assessment. The municipal government and communities aim to provide 0.9 million RMB to each pilot community at least during the first three years after the local CI-friendly community rollout.

2.2. An Overview of Chinese healthcare system

A hierarchical, multi-tiered structure, including primary, secondary and tertiary hospital characterize the Chinese healthcare system. At the community level, primary hospitals and clinics serve as patients' initial point of contact, providing fundamental services such as preventive care, management of common illnesses, and chronic disease monitoring. Secondary and tertiary hospitals have advanced diagnostic tools, specialized medical services, and sophisticated treatment protocols. Secondary and tertiary hospitals offer a broader range of care, including specialist consultations and moderate complexity surgeries, handling critical cases and complex medical conditions. The quality of primary health care is relatively low in the multi-tiered structure in China, such as poor performance in the control of risk factors, inadequate education and qualifications of its workforce(Li et al., 2017).

To improve the quality of primary hospitals, the government has made efforts to strengthen the primary health care and alleviate the gap and unbalance of the Chinese healthcare system (Yip et al., 2019). The funding to primary health care has increased by more than tenfold, from 19 billion RMB in 2008 to 197 billion RMB in 2018 (Li et al., 2020). Nevertheless, primary hospitals are not capable for CI screening or diagnosis. Most patients are diagnosed in tertiary or secondary hospitals. 96% of AD patients are diagnosed in secondary and tertiary hospitals, only 4% of AD is diagnosed in primary hospitals or community-level facilities (Xiao et al., 2023).

3. Data and Empirical Strategy

3.1. Data and Sample

Data: The study uses Shanghai's health insurance claim database, which contains daily records of public health insurance enrollees. Public health insurance covers nearly 99.5% of the Chinese population. We examine patient-level data over five years, 2017–2021, spanning from the period before and after the implementation of the first three pilots of CI-friendly communities. The data are obtained using a stratified sampling method, which randomly selects 10% of patients in the city and collects all of their health care utilization records for 2017–2021. Patient information includes the dates of outpatient or inpatient care, health care utilization and expenditures, and individual characteristics, such as gender and date of birth.

This dataset has various advantages. First, it provides patient-level administrative data in Shanghai, one of the first pilot cities of CI-friendly communities nationally. Second, it contains precise and comprehensive measures of health-care utilization, including outpatient care and department, inpatient care and disease diagnosis code, and medical expenditures.

Sample: Since CI is an age-related condition, our sample comprises individuals aged 60 and above[2]. We exclude individuals admitted to specialist hospitals, such as maternity, ophthalmic, infectious disease, dermatology, and rectal hospitals. We construct a balanced panel dataset with 20 quarterly observations per individual (4 quarters × 5 years, 2017-2021).

Residence: To define the treatment status of patients, we must identify the communities of residence. However, the residence information is not available in the patient data. Following Feng et al. (2020), we use the locations of primary care visits as a proxy. Specifically, if all of a patient's primary care visits in a given calendar year were in the same community, we assume that to be the community where the patient lived. This approach is supported by two facts. First, proximity is a primary reason for the location choice of primary care, since primary care facilities across communities offer very similar medical services, including primary care, rehabilitation, and disease prevention. Second, Shanghai has 249 primary care facilities serving its 215 communities, with each community having at least one primary care facility. Each facility primarily provides services for residents in the same community, and patients rarely seek primary care in other communities. Individuals who visited primary care facilities in different communities account for merely 5.3% of our sample, which are excluded from the analysis.

Treatment: The data period is 2017-2021, while the four waves of pilots were in October 2019, September 2020, September 2021, and September 2022. Our data cover the first three waves of pilots, allowing us to establish a natural control group—communities scheduled for the fourth-wave implementation (September 2022) remained unexposed to the intervention during our study period. Thus, in the primary analysis, we compare health care utilization of community-dwelling older adults between the first and the fourth waves, with the first wave as the treatment group, and the fourth wave as the control group.

3.2. Variables

Outcome variables: We measure older adults' health care utilization across two dimensions. The first focuses on CRD utilization, reflecting the direct intervention

[2] Among individuals aged 60 and above, 82% are enrolled in urban employee basic health insurance, which indicating they have worked for a long time in Shanghai.

target of CI-friendly communities. CRD utilization is quantified using quarterly indicators from 2017 to 2021: (1) the probability of having at least one CRD outpatient visit per quarter, (2) the frequency of CRD outpatient visits per quarter, and (3) average per-visit CRD expenditures. These measures are constructed as a balanced panel dataset with 20 quarterly observations per individual (4 quarters × 5 years). CRD is defined as neurology and geriatrics, with robustness checks testing alternative definitions in Table 11.

The second dimension captures general healthcare utilization patterns to assess broader effects. This includes three categories of quarterly measures: (1) acute care utilization (probability of ER visits and inpatient admissions), (2) facility tier selection (probability of visiting primary hospitals and secondary/tertiary hospitals), and (3) specialty care distribution (probability of outpatient visits to chronic disease departments such as cardiology and endocrinology, probability of outpatient visits to specific departments including ophthalmology, dermatology and dental care as placebo test). All outcomes are derived from patients' medical visit records, aggregated quarterly to align with the intervention timeline.

Control Variables: We incorporate several yearly community-level characteristics as control variables, sourced from the Shanghai Community Yearly Government Financial Report. Considering that the aging trend and financial support are important in the implementation effect of CI-friendly communities, we use a demographic indicator (the share of the population aged 60 and over) and three economic indicators (the proportion of community expenditure, health expenditure, and social security expenditure to local fiscal expenditure). Community expenditure refers to spending aimed at improving living standards, public services, housing, and environmental facilities. Health expenditure and social security expenditure are the expenditure on community public health and social security.

Additionally, we use gender and age variables obtained from Shanghai's health insurance claim database as individual-level controls.

Stratified Variables: We use several indicators as stratified variables. We measure the older adults' understanding of CRD using their previous CRD visit experiences. Those who have visited CRD before the first wave of the CI-friendly community pilot(2019) are assumed to have better knowledge about CRD, while those without prior visits are assumed to have less knowledge.

We also use the number of community-level aged-care facilities to measure the abundance of local aged care resources or abilities. Aged-care facilities refer to residential aged care facilities, daily aged care facilities and home-based aged care facilities.

Summary statistics: Table 1 shows the summary statistics for the dataset. Because our main analysis focuses on older adults with varying previously CRD outpatient experience, the statistics are reported by patients' CRD outpatient experience before the first wave of the CI-friendly community pilot.

Columns (1) and (2) of Table 1 show that demographic features are similar between the control and treatment groups. Individuals who have previously visited CRD are older and more likely to be males than those who never visited. In terms of health care utilization, in the full sample, 4% and 5% of individuals had at least a CRD outpatient visit per quarter in 2017 in the control and treatment groups, respectively.

3.3. Empirical Strategy

To evaluate the impact of CI-friendly communities on health care utilization, we exploit the variation in the timing of policy implementation in the first wave of pilot communities and the fourth wave of pilot communities to construct a standard difference-in-differences (DID) framework. We use the following empirical strategy to investigate the effect of CI-friendly communities:

$$Utilization_{ist} = \beta_0 + \beta_1 Treat_s * Post_{it} + \beta_2 Treat_s + \beta_3 Post_{it} + X_{ist}\rho + \sigma_t C_s + \delta_i + \rho_t + \varepsilon_{ist} \quad (1)$$

The dependent variable $Utilization_{ist}$ denotes the health care utilization behaviors in different departments and expenditure for individual i in community s, quarter t. In the primary results, we focus on the probability, frequency, and expenditure of CRD visits. We define CRD that includes neurology and geriatrics departments and adjust its definition in robustness checks. $Post_{it}$ is a binary variable that equals 1 for dates after the third quarter of 2019, and 0 otherwise. X_{ist} controls age (in month) fixed effect. And we control individual fixed effect δ_i and quarter-by-year fixed effect ρ_t.

Health care utilization can be correlated with local community-level characteristics. Thus we include interaction terms of community characteristics C_s in the initial data year of our data (2017) and a vector of year-specific coefficients σ_t. The community characteristics include the population share of age 60 and older, the ratio of community expenditure to fiscal expenditure, the ratio of public health expenditure to fiscal expenditure, and the ratio of social security expenditure to fiscal expenditure. There are no pre-trends of these community controls during 2017-2019 (Figure 2).

We define a binary indicator of treatment, $Treat_s$, which equals 1 if individual i resides in any of the first-wave pilot CI-friendly communities and 0 otherwise. The point estimate β_1 denotes the effect of the implementation of CI-friendly communities. Standard errors are clustered at the community level.

Although our sampling period covers three waves of pilot communities, we restrict the sample to two batches of communities. The treatment group consists of the communities in the first pilot wave, while the communities in the fourth pilot wave are in the control group, which only started their pilot at the end of our sampling period in 2021. The advantage of using the first wave as the treatment group and the fourth wave as the control group is that the first-wave rollout lasts the longest to date, and the fourth-wave communities (untreated during the sample period) provide a more comparable control group than nonpilot communities. In the robustness checks, we use a staggered DID model incorporating all four pilot waves and alternative sample constructions (Table 10).

4. Results

4.1. Main Results and Mechanisms

Table 2 shows that the estimated effects of CI-friendly communities on the probability and frequency of visiting CRD, using equation (1). Our results in column (1), Table 2, show that CI-friendly communities increase the probability of visiting CRD by 0.7 pp (13.73%) and the frequency of CRD visits by 0.02 times (17.24%), respectively.

The effect of CI-friendly communities on CRD care utilization may involve both the information effect and substitution effect, each influencing CRD care utilization in different ways. The information effect may raise the probability of CRD outpatient visits via increased awareness of CI, while the substitution effect may crowd out CRD outpatient visits. The results in column (1), Table 2, show that the information effect dominates the substitution effect in the full sample.

We further test the information and substitution effects by prior CRD experiences before the first wave of the CI-friendly community pilot. Columns (2) and (3) of Table 2 suggest the results of the full sample are driven by people who have not previously visited CRD outpatient. The probability of visiting CRD respectively increase by 0.9 pp, and the frequency of visiting CRD increase by 0.018 times, while no significant effects are observed on those who have previously visited CRD. The standardized effect sizes are also presented. Note that the confidence intervals between the two subgroup analyses overlap, although the effects on those without CRD experiences are insignificant. Therefore, we introduce interaction terms to explore whether there are statistically different effects between the two subgroups (Table 7).

Our finding suggests that CI-friendly communities encourage more utilization of CRD for those who have never been to CRD. These individuals may have limited knowledge about CI, and the CI-friendly communities help raise awareness and provide early screening. Among those who have previously visited CRD, the program could still increase awareness, leading to more healthcare utilization. However, our estimates show that their probability, frequency, and expenditure of CRD visits change little after the implementation of CI-friendly communities. This may be due to their prior knowledge about CI, which likely attenuates the information effect. If the substitution effect dominates, those who have visited CRD may reduce their utilization of CRD services, or at least not significantly increase their CRD services use, considering their potential modest information effect. Overall, the results in column (3), Table 2, show that the substitution effect can be small compared to the information effect, among those with or without CRD experiences.

In addition to the information and substitution effects, a health-enhancing effect may exist, where CI-friendly communities reduce CRD service utilization through the improvement in health. However, the results in Table 2 do not support this health-enhancing channel, likely because we can only observe the pilot in years 0–2 for the post-treatment period, and any longer-term health effect cannot be detected. Similar results can also be observed in Figure 3.

4.2. Heterogeneity and Dynamic Effects

The effect of CI-friendly communities may depend on the availability of elderly care resources. As mentioned in the institutional background, CI-friendly communities integrate healthcare and social support resources in neighborhoods, especially aged-care institutions. In China, most primary care facilities do not establish a department for cognitive diseases, whereas aged-care institutions often have more experience screening and caring for older persons with cognitive diseases. Thus, we seek to examine the role of aged-care institutions.

Table 3 shows that the effects of CI-friendly communities on the probability of CRD visits by the abundance of community aged-care facilities. We separate the communities into two groups using the median number of aged-care facilities per older person in the community as a cut-off. Table 3 shows CI-friendly communities have a greater effect on those who have not previously visit CRD in communities with more aged-care facilities. These results suggest aged-care facilities play an important role in screening and information sharing in CI-friendly communities.

Because the risk of CI increases with age, the effect of CI-friendly communities on CRD utilization may also rise with age. We test the effect by age group. Table 4 shows the effect becomes larger for older age groups, though the effect on people who have previously visited CRD remains insignificant.

The key assumption of DID specification is parallel pre-trends, which means that in the absence of CI-friendly communities, the difference between the treatment group and the control group is constant over time. Following Moser et al. (2014), we estimate the DID estimator β separately for each quarter:

$$Utilization_{ist} = \beta_0 + \sum_{t=-11}^{8} \beta_t Treat_s * Quarter_{it} + \beta_2 Treat_s + \beta_3 Post_{it} + X_{ist}\rho + \delta_i + \sigma_t C_s + \rho_t + \varepsilon_{ist},$$

where the variable $Quarter_{it}$ represents an indicator variable for each quarter before and after the implementation of CI-friendly communities. Here, we exclude the second quarter of 2019 as the benchmark category. Figure 3 depicts the estimates for each quarter. The coefficients are close to 0 before the implementation of CI-friendly communities. These results suggest that there are no pre-existing trends in the key outcomes. Consistent with the results in Table 2, Figure 3 shows the coefficients increase over time for those who have not previously visited CRD, whereas no distinguishable increase in the coefficients emerges for those who have.

4.3. Further Analysis

In addition to the effects on CRD outpatient visits, CI-friendly communities may affect health care utilization in other ways, for instance, by increasing health awareness and assisting patients in achieving a more holistic approach to managing their health, similar to the *information effect* we mentioned before. Furthermore, CI-friendly communities may help promote a tiered health care system that encourages more visits to primary care facilities, improving care efficiency, although the Chinese primary care system still lacks the capacity to diagnose and treat cognition-related diseases.

In columns (1)–(3) Table 5, we examine these spillover effects of CI-friendly communities on ER visits, inpatient rates, and chronic disease outpatient rates. We find that for those who have not visited CRD before, the probability of visiting an ER declines significantly, while other outcomes change little. The results indicate that CI-friendly communities help reduce ER visits for those who have never visited CRD, whereas it is not yet effective for inpatient or chronic disease department health care use.

In columns (4) and (5) of Table 5, we examine the effects of CI-friendly communities on hospital visits. The effect on secondary and tertiary hospital visits is negative and significant, whereas the probability of visiting primary care hospitals increases significantly after implementation of CI-friendly communities. The results suggest that CI-frienly communities may help strengthen the gatekeeping function of primary care and reduce utilization in advanced facilities, by increasing awareness of self health and primary care.

Considering that the coefficients we estimate are based on a relatively short-term period, we observe little change in longer term health outcomes. That said, even in the short term, the CI-friendly communities are found to enhance health awareness, increase primary care use, and relieve pressure on ER and higher-level hospitals to promote a tiered care system.

4.4. Robustness Checks

To alleviate the concern about COVID-19, in *alternative specifications* we replace quarter-by-year fixed effects with month-by-year fixed effects (Panel A Table 6). We also show the results without controlling for the community characteristics (Panel B Table 6) to test the sensitivity to covariates. Furthermore, considering that the number of CRD visits is a count variable, we use Poisson regression rather than a linear model (Panel C Table 6); the results are robust.

Considering the much smaller sample size for those who have previously visited a CRD than for those who have never visited, which may drive the differences in their estimates, we use an alternative model with interaction terms to test whether the difference exists between the two groups. The results in Table 7 show that the effect on the probability and frequency of CRD outpatient visits for those who have not previously visited CRD is much larger.

To ensure the results are mainly driven by CI-friendly communities, rather than by confounding effects, we use visits to other departments as *placebo tests*. If the increase in CRD outpatient visits is indeed due to CI-friendly communities, other departments should have no change. As shown in Table 8, we find no significant effect on other departments. These results provide further evidence that the estimated effects are not driven by other policies or confounding factors.

To alleviate the concern regarding mortality-related attrition bias, we further exclude individuals whose health insurance accounts were closed at any time during 2017-2021 (Table 9). Each year, additional funds are credited to an individual account if the individual is alive. Otherwise, the account is closed. We therefore code the survival status of individuals through their account status. The results in Table 9 demonstrate consistency with those in Table 2.

To address the concern that the first and fourth waves of pilot communities may not be the most comparable prior to the program rollout, we further use different waves of pilot communities to test the robustness of baseline results. Table 10 shows that the positive effect of CI-friendly communities on CRD care utilization remains in samples with different combinations of treatment and control groups.

As cognitive diseases may be diagnosed in different departments, we adjust the definition of CRD to demonstrate the robustness of the main results (in Table 2). In Panel A, Table 11, we first exclude the geriatrics department from CRD, meaning CRD only includes the neurology department. In Panel B, Table 11, we further include the psychiatric department in CRD. As expected, we observe consistent and similar estimates, suggesting the estimates are robust across different definitions of CRD.

5. Conclusion

CI has become a serious and growing public health problem worldwide. Many countries are grappling with the unprecedented challenge of safeguarding the well-being of people with CI. CI-friendly communities aim to create dementia-inclusive societies, but there is limited research on their effects. In China, the burden of dementia is growing rapidly, making it crucial to evaluate the effectiveness of recent policy interventions such as CI-friendly communities. This study draws on quasi-experimental evidence from the implementation of CI-friendly communities in Shanghai, China, to examine their early effects on health care utilization.

Our DID analysis reveals three key findings. First, the implementation of CI-friendly communities has a significant information effect in the short term, increasing the probability (0.7 pp, 13.73%) and frequency (0.02 times, 17.24%) of CRD visits. In particular, the effect is more significant among individuals who have not previously visited CRD, whereas the effect on those who have visited CRD is insignificant. Second, the effect of CI-friendly communities depends on the local aged-care infrastructure. Specifically, the effect is larger in the communities with more abundant aged-care facilities. Third, CI-friendly communities also affect other forms of health care utilization. They reduce ER visits and increase the probability of visiting primary care hospitals, which suggests that the implementation of CI-friendly communities helps avoid adverse health events and promote a tiered care system by promoting primary care use.

This study has two main limitations. First, administrative data contain limited individual patient-level information. Therefore, the mechanisms we explore are suggestive rather than complete. Second, because the pilot of CI-friendly communities is still in its early stages, our study can only identify short-term effects. Therefore, future studies would aim to identify other potential mechanisms and the longer-term effects.

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Statements and Declarations

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The IZA Discussion Paper Series serves as a preprint server to deposit latest research for early feedback. News media inquiries may be directed to Xi Chen xi.chen@yale.edu or Jin Feng jfeng@fudan.edu.cn. We appreciate your interest.

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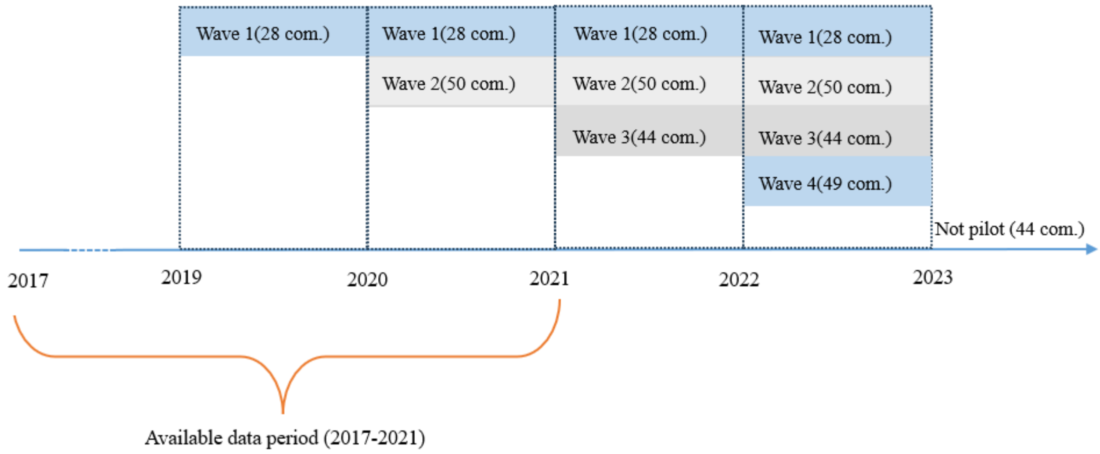
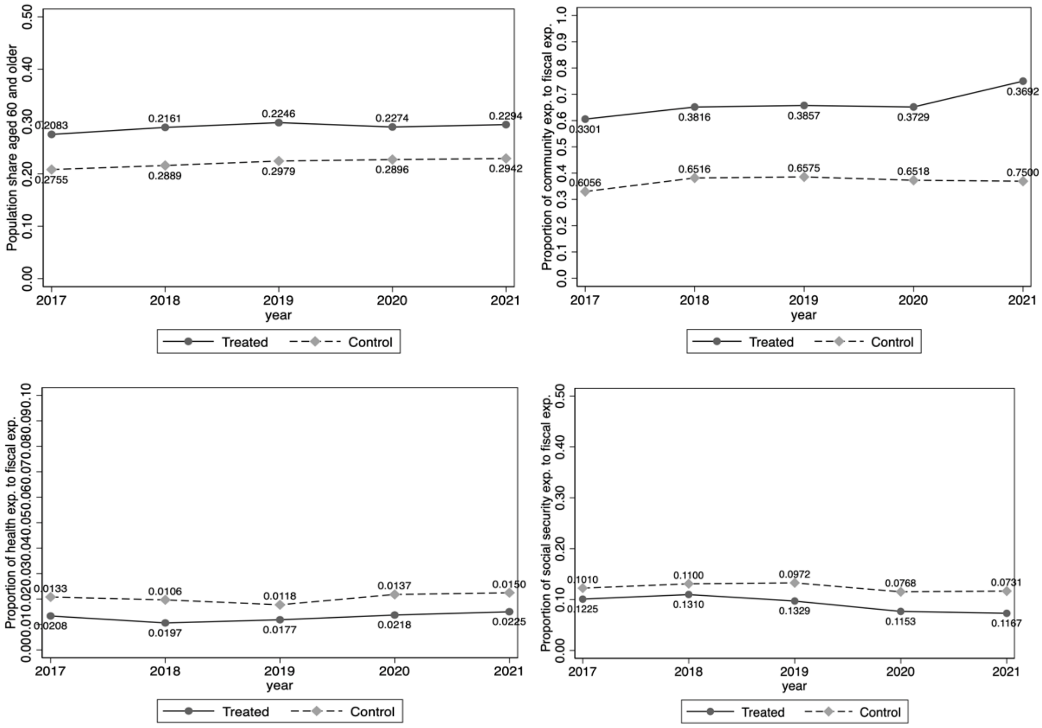
Figure 1: Roll-out timeline for CI-friendly community pilot program in Shanghai



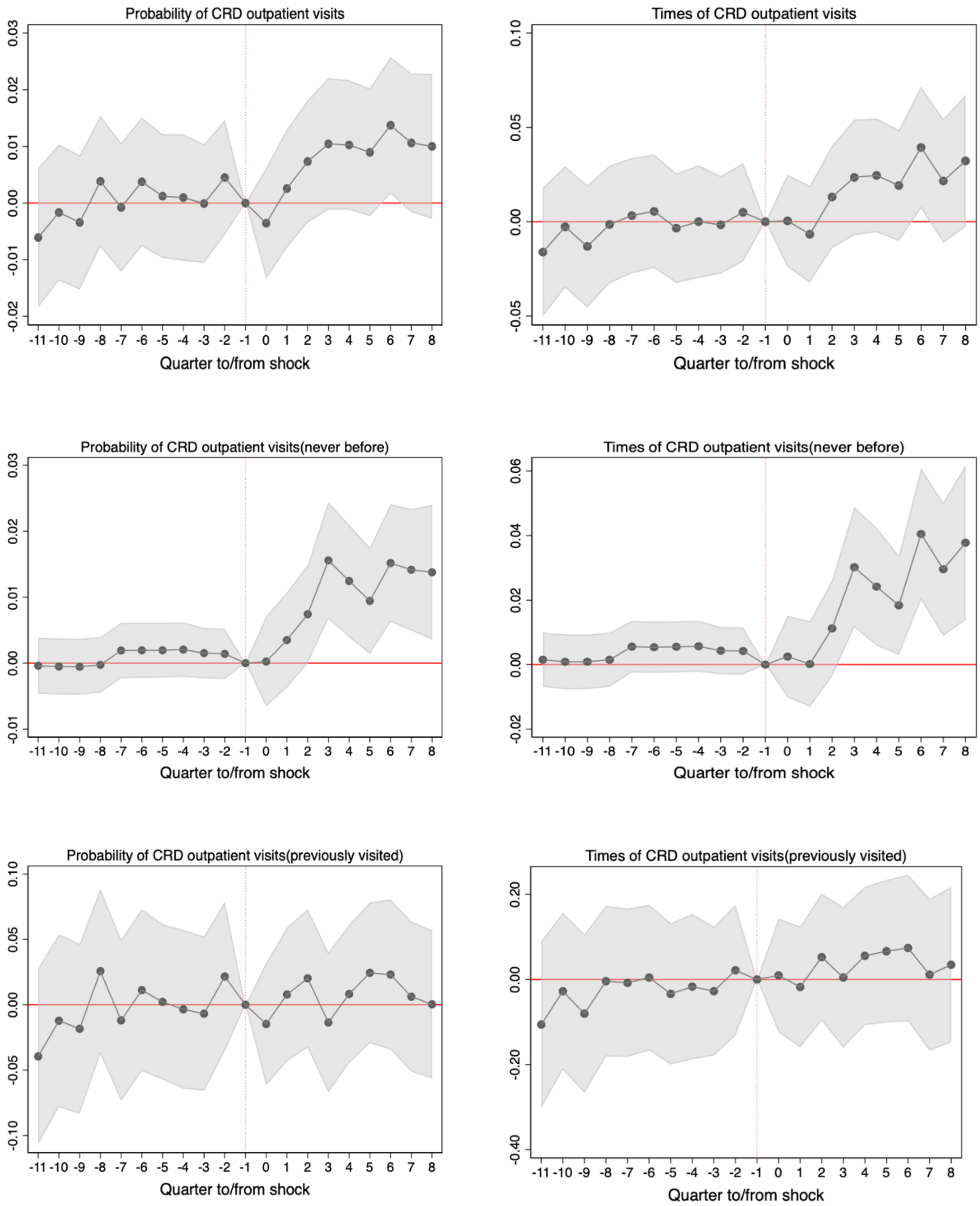
Notes: Wave 1 started in October 2019; wave 2 in September 2020; wave 3 in September 2021; and wave 4 in September 2022.

Figure 2: Community characteristics (the control group vs. the treated group)



Notes: Data are from Shanghai Community Government Financial Report by year. These figures plot the share of population aged 60 and over (upper left panel) and community expenditure (upper right panel), public health expenditure (lower left panel) and social security expenditure (lower right panel), as a percentage of fiscal expenditure respectively by treated and control communities, 2017–2021. Community expenditure includes the public expenditure on community public affairs or public facilities purchasing and maintaining. Public health expenditure and social security expenditure are the expenditure on community public health or social security. Treated communities are those in pilot wave 1, 2019Q3. Control communities are those in pilot wave 4, 2022Q3.

Figure 3: Dynamic effects of CI-friendly communities on CRD outpatient visits



Notes: The X-axis indicates a particular quarter relative to the benchmark quarter. CI-friendly communities were implemented in month 0. The dataset and control variables are the same as in Table 2. The shadow area indicates 95% confidence intervals.

Table 1: Summary Statistics

	(1)	(2)	(3)	(4)	(5)	(6)
	All sample		Never visited CRD before		Previously visited CRD	
	Control	treat	Control	treat	Control	treat
Panel A: Demographics						
Age	70.11 (8.44)	70.07 (8.49)	69.95 (8.47)	69.79 (8.40)	71.01 (8.17)	71.50 (8.79)
Female	0.50 (0.50)	0.50 (0.50)	0.51 (0.50)	0.51 (0.50)	0.44 (0.50)	0.47 (0.50)
Panel B: Utilization 2017						
Probability of CRD outpatient visits	0.04 (0.20)	0.05 (0.21)	0	0	0.25 (0.43)	0.26 (0.44)
Times of CRD outpatient visits	0.10 (0.67)	0.10 (0.54)	0	0	0.57 (1.52)	0.56 (1.17)
Expenditure of CRD outpatient visits	13.42 (84.33)	15.09 (100.39)	0	0	78.15 (190.69)	85.29 (225.82)
Probability of inpatient admission	0.05 (0.22)	0.04 (0.19)	0.04 (0.20)	0.03 (0.18)	0.08 (0.27)	0.05 (0.23)
Panel C: Utilization 2021						
Probability of CRD outpatient visits	0.04 (0.21)	0.06 (0.24)	0.03 (0.17)	0.04 (0.20)	0.14 (0.35)	0.18 (0.38)
Times of CRD outpatient visits	0.08 (0.46)	0.14 (0.68)	0.05 (0.36)	0.09 (0.53)	0.30 (0.87)	0.46 (1.26)
Expenditure of CRD outpatient visits	17.24 (153.03)	25.45 (188.45)	12.36 (147.95)	15.66 (115.57)	50.73 (180.65)	89.02 (418.16)
Probability of inpatient admission	0.04 (0.21)	0.04 (0.19)	0.04 (0.20)	0.03 (0.18)	0.06 (0.24)	0.04 (0.20)
Panel D: Community characteristics						
Population share aged 60 and above	0.22 (0.09)	0.29 (0.06)	-	-	-	-
community exp/fiscal exp	0.37 (0.24)	0.65 (0.18)	-	-	-	-
health exp /fiscal exp	0.02 (0.02)	0.01 (0.01)	-	-	-	-
Social security exp/fiscal exp	0.12 (0.08)	0.09 (0.07)	-	-	-	-

Notes: This table shows summary statistics in our full, treated, and control samples. Health care utilization is measured in both 2017 and 2021, including the utilization of CRD outpatient and inpatient care. Our dataset is aggregated at the quarter-individual level. Standard deviations are reported in parentheses.

Table 2：Effects of CI-friendly communities on CRD outpatient visits

	(1) All sample	(2) Never visited CRD before	(3) Previously visited CRD
Panel A: Probability of CRD outpatient visits			
$Treat_s * Post_{it}$	0.007**	0.009***	0.008
	(0.003)	(0.002)	(0.013)
Observations	199,069	167,942	31,121
R-squared	0.415	0.311	0.357
Mean of Y	0.051	0.000	0.280
standardized effect in SD	0.033	0.067	0.019
Panel B: Times of CRD outpatient visits			
$Treat_s * Post_{it}$	0.020**	0.018***	0.053
	(0.009)	(0.004)	(0.048)
Observations	199,069	167,942	31,121
R-squared	0.498	0.389	0.483
Mean of Y	0.116	0.000	0.640
standardized effect in SD	0.032	0.056	0.039
Panel C: Expenditure of CRD outpatient visits			
$Treat_s * Post_{it}$	1.541	0.689	8.282
	(1.599)	(0.919)	(8.679)
Observations	199,069	167,942	31,121
R-squared	0.355	0.248	0.375
Mean of Y	16.92	0.000	93.212
standardized effect in SD	0.013	0.010	0.028

Notes: Standard errors clustered at the community level are reported in parentheses. Column (2) uses individuals who have never visited CRD between 2017Q1 and 2019Q3; otherwise, individuals are defined as those who have previously visited CRD. We controlled individual characteristics, community characteristics individual fixed effect and time fixed effect, as equation (1). Individual characteristics include age fixed effect, and community covariates include the population share of age 60 and older and fiscal expenditure structure (i.e., the ratio of community expenditure to fiscal expenditure, the ratio of public health expenditure to fiscal expenditure, and the ratio of social security expenditure to fiscal expenditure). Mean of Y measures the pre-program means of the outcome variables. The dataset is aggregated at the quarter-individual level. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 3: Effects of CI-friendly communities on the probability of CRD outpatient visits, by abundance of aged-care facilities

	(1)	(2)	(3)
	All sample	Never visited CRD before	Previously visited CRD
Panel A: Abundant aged-care facilities (above median level)			
$Treat_s * Post_{it}$	0.012***	0.014***	0.011
	(0.005)	(0.003)	(0.023)
Observations	85,857	74,637	11,215
R-squared	0.412	0.282	0.378
Mean of Y	0.039	0.000	0.260
standardized effect in SD	0.058	0.110	0.026
Panel B: Not abundant aged-care facilities (below median level)			
$Treat_s * Post_{it}$	0.006	0.004	0.026
	(0.004)	(0.003)	(0.017)
Observations	104,120	85,758	18,356
R-squared	0.419	0.339	0.356
Mean of Y	0.059	0.000	0.288
standardized effect in SD	0.025	0.029	0.060

Notes: Standard errors clustered at the community level are reported in parentheses. Panel A is the communities with an above-median number of aged-care facilities in the pre-pilot year, 2019. Aged care facilities include residential aged care facilities, daily aged care facilities and home-based aged care facilities. Panel B contains all other communities. The control variables are the same as in Table 2. Mean of Y measures the pre-program means of the outcome variables. The dataset is aggregated at the quarter-individual level. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 4: Effects of CI-friendly communities on the probability of CRD outpatient visits, by age group

	(1) All sample	(2) Never visited CRD before	(3) Previously visited CRD
Panel A: 60–69 years old			
$Treat_s * Post_{it}$	0.004	0.005**	0.000
	(0.004)	(0.003)	(0.018)
Observations	115,330	97,803	17,527
R-squared	0.395	0.280	0.341
Mean of Y	0.044	0.000	0.261
standardized effect in SD	0.019	0.043	0.000
Panel B: 70–79 years old			
$Treat_s * Post_{it}$	0.006	0.007*	0.002
	(0.006)	(0.004)	(0.027)
Observations	51,907	42,812	9,095
R-squared	0.448	0.326	0.396
Mean of Y	0.055	0.000	0.285
standardized effect in SD	0.025	0.049	0.004
Panel C:80–89 years old			
$Treat_s * Post_{it}$	0.007	0.012**	0.039
	(0.009)	(0.006)	(0.035)
Observations	25,334	20,292	5,042
R-squared	0.521	0.411	0.496
Mean of Y	0.074	0.000	0.300
standardized effect in SD	0.026	0.078	0.090

Notes: Standard errors clustered at the community level are reported in parentheses. The control variables are the same as in Table 2. Mean of Y measures the pre-program means of the outcome variables. The dataset is aggregated at the quarter-individual level. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 5: Effects of CI-friendly communities on other health care utilization

	(1) Prob of emergency room visit	(2) Prob of inpatient visit	(3) Prob of Chronic disease department outpatient visit	(4) Prob of secondary and tertiary hospitals	(5) Prob of primary hospitals
Panel A： All sample					
$Treat_s *$	-0.001	0.004	0.002	-0.003	0.018***
$Post_{it}$	(0.003)	(0.002)	(0.004)	(0.006)	(0.007)
Observations	199,069	199,069	199,069	199,069	199,069
R-squared	0.176	0.199	0.526	0.439	0.519
Mean of Y	0.081	0.0340	0.105	0.469	0.531
Panel B: Never visited CRD before					
$Treat_s *$	-0.002	0.003	0.005	-0.006	0.014*
$Post_{it}$	(0.003)	(0.003)	(0.004)	(0.007)	(0.007)
Observations	167,942	167,942	167,942	167,942	167,942
R-squared	0.173	0.205	0.511	0.424	0.520
Mean of Y	0.069	0.078	0.036	0.461	0.522
Panel C: Have previously visited CRD					
$Treat_s *$	0.009	0.006	-0.011	0.004	0.041**
$Post_{it}$	(0.010)	(0.007)	(0.012)	(0.015)	(0.017)
Observations	31,121	31,121	31,121	31,121	31,121
R-squared	0.177	0.180	0.538	0.417	0.512
Mean of Y	0.134	0.229	0.056	0.731	0.570

Notes: Standard errors clustered at the community level are reported in parentheses. Chronic disease department includes cardiology or cardiovascular medicine department, endocrinology department. The control variables are the same as in Table 2. Mean of Y measures the pre-program means of the outcome variables. The dataset is aggregated at the quarter-individual level. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 6: Effects of CI-friendly communities on CRD outpatient visits using alternative Specification

	(1) All sample	(2) Never visited CRD before	(3) Previously visited CRD
Panel A: Control month-by-year FE			
1: Probability of CRD outpatient visits			
$Treat_s * Post_{it}$	0.004**	0.004***	0.010
	(0.002)	(0.001)	(0.009)
Observations	512,901	428,081	84,802
R-squared	0.328	0.153	0.310
2: Times of CRD outpatient visits			
$Treat_s * Post_{it}$	0.006**	0.005***	0.021
	(0.003)	(0.002)	(0.016)
Observations	512,901	428,081	84,802
R-squared	0.319	0.136	0.314
3: Expenditure of CRD outpatient visits			
$Treat_s * Post_{it}$	1.485	0.276	8.634
	(1.140)	(0.474)	(6.353)
Observations	512,901	428,081	84,802
R-squared	0.247	0.065	0.269
Panel B: Without community controls			
1: Probability of CRD outpatient visits			
$Treat_s * Post_{it}$	0.007**	0.009***	0.011
	(0.003)	(0.002)	(0.012)
Observations	199,069	167,942	31,121
R-squared	0.414	0.311	0.354
2: Times of CRD outpatient visits			
$Treat_s * Post_{it}$	0.018**	0.017***	0.047
	(0.009)	(0.004)	(0.044)
Observations	199,069	167,942	31,121
R-squared	0.497	0.388	0.481
3: Expenditure of CRD outpatient visits			
$Treat_s * Post_{it}$	1.826	0.532	11.321
	(1.498)	(0.925)	(7.324)
Observations	199,069	167,942	31,121
R-squared	0.354	0.248	0.373
Panel C: Poisson regression			
Times of CRD outpatient visits			
$Treat_s * Post_{it}$	1.243**	1.748***	1.007
	(0.109)	(0.160)	(0.121)
Observations	198,819	80,956	30,592
Mean of Y	0.103	0.027	0.516

Notes: Panel A controls for age fixed effect, individual fixed effect and quarter-by-year time fixed effect. Panel B and Panel C control for community control(population share of age 60, the ratio of community expenditure to fiscal expenditure, the ratio of public health expenditure to fiscal expenditure, and the ratio of social security expenditure to fiscal expenditure), age fixed effect, individual fixed effect and quarter-by-year time fixed effect. Standard errors clustered at the community level are reported in parentheses. The dataset and control variables are the same as in Table 2. The estimation results we show in Panel C are the exponentiated coefficients. Mean of Y in Panel C measures the means of the outcome variables in the full regression sample. The dataset is aggregated at the quarter-individual level. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 7: Interactive effects of CI-friendly community roll-out and prior CRD outpatient visits on subsequent CRD visits

	(1) Probability of CRD outpatient visits	(2) Times of CRD outpatient visits	(3) Expenditure of CRD outpatient visits
$Never\ visited\ CRD\ before * Treat_s * Post_{it}$	0.119***	0.245***	22.176***
	(0.010)	(0.036)	(6.228)
$Treat_s * Post_{it}$	0.027***	0.059***	5.338***
	(0.002)	(0.006)	(1.177)
Observations	199,069	199,069	199,069
R-squared	0.418	0.499	0.355

Notes: Standard errors clustered at the community level are reported in parentheses. *Never visited CRD before* was defined as a binary indicator, where a value of 1 was assigned to individuals with no prior CRD department visits before the pilot program, and 0 to those with at least one visit. The definition of $Treat_s$ and $Post_{it}$ are same as the specification in equation(1). The dataset and control variables are the same as in Table 2. The dataset is aggregated at the quarter-individual level. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 8: Placebo tests using the probability of other outpatient departments visits

	(1) All Sample	(2) Never visited CRD before	(3) Previously visited CRD
Panel A: Ophthalmology department			
$Treat_s * Post_{it}$	0.002	0.003	-0.007
	(0.003)	(0.003)	(0.009)
Observations	199,069	167,942	31,121
R-squared	0.299	0.300	0.292
Mean of Y	0.0628	0.0548	0.0986
Panel B: Dermatology department			
$Treat_s * Post_{it}$	0.003	0.003	0.008
	(0.003)	(0.003)	(0.009)
Observations	199,069	167,942	31,121
R-squared	0.243	0.249	0.222
Mean of Y	0.0579	0.0508	0.0898
Panel C: Oral department			
$Treat_s * Post_{it}$	-0.002	-0.001	-0.011
	(0.003)	(0.003)	(0.009)
Observations	199,069	167,942	31,121
R-squared	0.198	0.195	0.208
Mean of Y	0.0788	0.0721	0.109

Notes: The outcome variables are probability of having at least one specific department(ophthalmology, dermatology or oral) outpatient visit per quarter. Standard errors clustered at the community level are reported in parentheses. The dataset and control variables are the same as in Table 2. The dataset is aggregated at the quarter-individual level. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 9: Alternative sample by excluding closed health insurance account

	(1) All sample	(2) Never visited CRD before	(3) Previously visited CRD
Panel A: Probability of CRD outpatient visits			
$Treat_s * Post_{it}$	0.010***	0.010***	0.014
	(0.003)	(0.002)	(0.015)
Observations	151,893	128,665	23,215
R-squared	0.418	0.316	0.360
Mean of Y	0.0496	0	0.279
Panel B: Times of CRD outpatient visits			
$Treat_s * Post_{it}$	0.025***	0.021***	0.066
	(0.009)	(0.005)	(0.050)
Observations	151,893	128,665	23,215
R-squared	0.514	0.410	0.492
Mean of Y	0.111	0	0.628
Panel C: Expenditure of CRD outpatient visits			
$Treat_s * Post_{it}$	2.158	0.872	10.064
	(1.799)	(1.075)	(9.985)
Observations	151,893	128,665	23,215
R-squared	0.363	0.185	0.420
Mean of Y	16.53	0	93.15

Notes: The sample are constructed of the older adults age 60 or above, whose health insurance account is always active in Shanghai during 2017-2021. Standard errors clustered at the community level are reported in parentheses. The dataset and control variables are the same as in Table 2. The dataset is aggregated at the quarter-individual level. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 10: Effects of CI-friendly communities on the probability of CRD outpatient visits using different waves of pilot communities

	(1) All Sample	(2) Never visited CRD before	(3) Previously visited CRD
Panel A: Baseline sample			
$Treat_s * Post_{it}$	0.007**	0.009***	0.008
	(0.003)	(0.002)	(0.013)
Observations	199,069	167,942	31,121
R-squared	0.415	0.311	0.357
Mean of Y	0.051	0	0.280
Panel B: All waves of pilot communities			
$Treat_s * Post_{it}$	0.003*	0.002**	0.011
	(0.002)	(0.001)	(0.007)
Observations	436,885	340,149	96,730
R-squared	0.416	0.263	0.326
Mean of Y	0.0527	0	0.221
Panel C: Second and fourth waves			
$Treat_s * Post_{it}$	0.003	0.005***	0.012
	(0.002)	(0.002)	(0.009)
Observations	267,345	213,205	54,139
R-squared	0.417	0.265	0.336
Mean of Y	0.053	0.000	0.237

Notes: Standard errors clustered at the community level are reported in parentheses. The dataset and control variables are the same as in Table 2. The dataset is aggregated at the quarter-individual level. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 11: Effects of CI-friendly communities on the probability of CRD outpatient visits, by Alternative definition of CRD

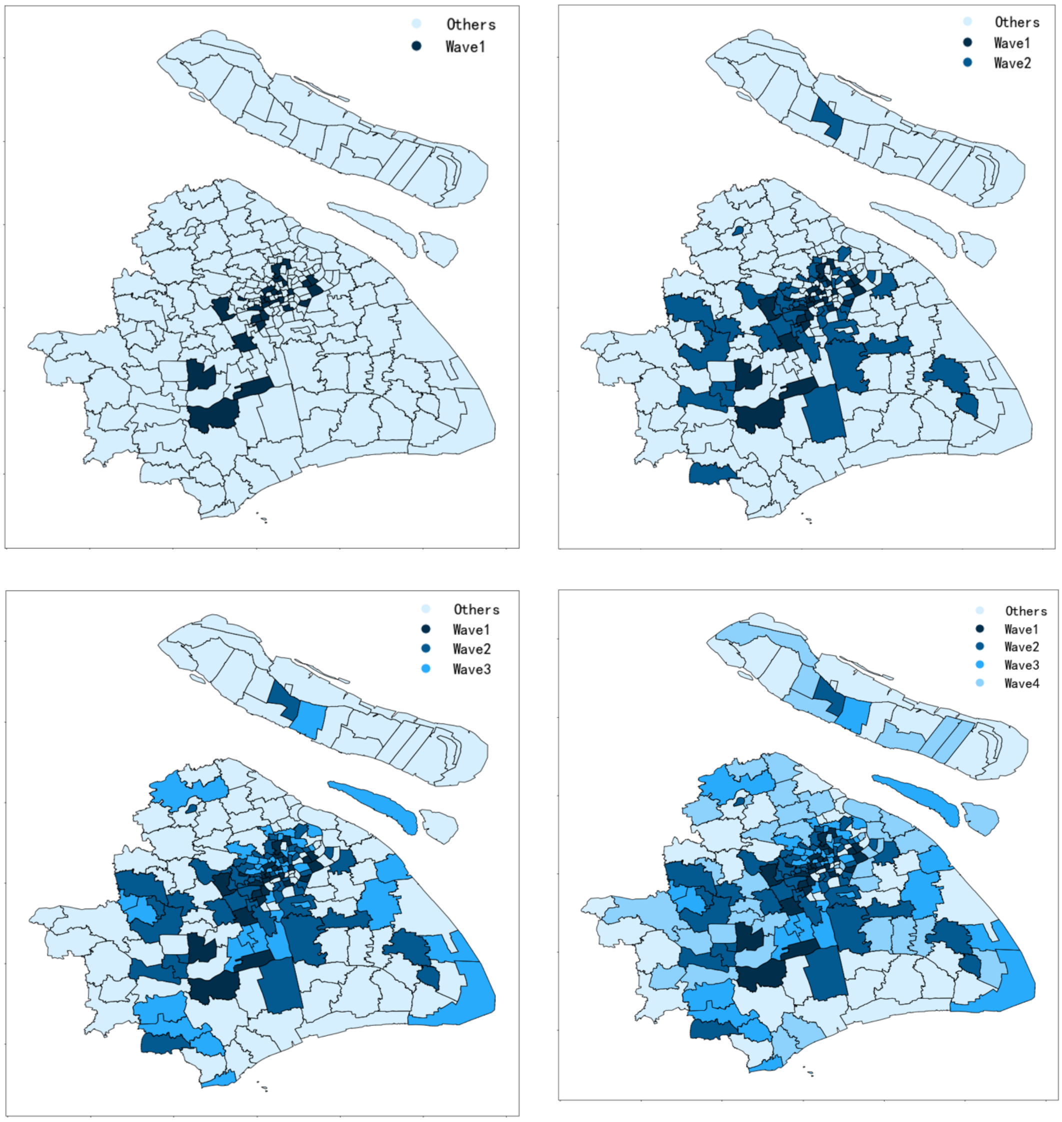
	(1) All Sample	(2) Never visited CRD before	(3) Previously visited CRD
Panel A: Cognition disease related department (excluding the geriatrics department)			
$Treat_s * Post_{it}$	0.006**	0.006***	0.017
	(0.003)	(0.002)	(0.014)
Observations	199,069	172,362	26,701
R-squared	0.405	0.304	0.347
Mean of Y	0.0410	0	0.269
Panel B: Cognition disease related department (add psychiatric department)			
$Treat_s * Post_{it}$	0.007**	0.010***	0.010
	(0.003)	(0.002)	(0.013)
Observations	199,069	162,680	36,383
R-squared	0.480	0.320	0.421
Mean of Y	0.0650	0	0.314

Notes: Standard errors clustered at the community level are reported in parentheses. The dataset and control variables are the same as in Table 2. The dataset is aggregated at the quarter-individual level. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Online Appendix

Figure A1: An example program site

Figure A2: The implementation of CI-friendly communities in Shanghai by wave



Notes: Wave 1 started in October 2019; wave 2 in September 2020; wave 3 in September 2021; and wave 4 in September 2022. Four panels plot statuses of program roll-out 2019-2022, respectively.